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BRUCELLOSIS

Questions and Answers

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The Disease—Symptoms, Causes, and Effects

What is brucellosis?

It is a contagious, bacterial disease of animals that also affects humans. In this country, the farm animals most commonly threatened by brucellosis are cattle and, to a lesser extent, swine. The disease is also known as contagious abortion or Bang's disease in livestock. In man, it's known as undulant fever because of the intermittent fever accompanying human infection. Another name for human brucellosis is Malta fever.

How serious is brucellosis?

Considering the damage done by the infection in animals—decreased milk production, weight loss of meat animals, and loss of young—it is one of the most serious diseases of livestock. The swiftness with which it spreads, and the fact that it is transmissible to humans, make it all the more serious.

What disease agents cause brucellosis?

The disease is caused by bacteria of the genus *Brucella*, named for David Bruce who first isolated and identified the bacteria which cause Malta fever (human brucellosis) in 1887. We are mainly concerned with three species of *Brucella*: *B. abortus*, principally affecting cattle; *B. suis*, principally affecting swine; and *B. melitensis*, principally affecting goats. A disease in dogs is also caused by *Brucella*, but it does not affect domestic livestock. In cattle, the disease usually localizes in the reproductive organs or the udder. Bacteria are shed in milk or leave the body with the aborted fetus, the afterbirth, or with discharges from the reproductive tract.

What are the symptoms of brucellosis?

There is no way to tell infected cattle by their appearance. The most outstanding symptoms in pregnant females are abortion, birth of weak calves, and vaginal discharges. Affected herds can have 40 percent fewer calves. Milk production may be reduced about 20 percent due to changes in normal lactation

period caused by abortions and delayed conceptions. Not all infected cows abort, but those that do usually abort between the fifth and seventh month of pregnancy. Infected cows seldom abort more than once, but calves born from later pregnancies may be weak and unhealthy. Even though their calves may appear healthy, infected cows continue to harbor and discharge infectious organisms and should be regarded as dangerous. Periodic "abortion storms" may occur among herds with longstanding infection. Other signs of brucellosis include apparent lowering of fertility with poor conception rates, retained afterbirths with resulting uterine infections, and occasionally enlarged arthritic joints. Infected bulls may have swollen testicles.

Is the infected bull a threat to other cattle?

Natural service by infected bulls is not an important means of transmission. Semen from infected bulls used in artificial insemination poses a danger since the semen is deposited directly into the cervical canal and uterus.

Can brucellosis be in a herd without causing abortions?

Yes. Brucellosis is noted for its long, variable incubation period; and infection may be in a herd for weeks or even months before any pregnant female aborts. Not all pregnant females will abort.

How is brucellosis spread?

It is commonly transmitted to susceptible animals by direct contact with infected animals. It is also transmitted to susceptible animals in contact with an environment which has been contaminated with discharges from infected animals. Aborted fetuses, placental membranes, placental fluids, and the vaginal discharge that persists for several weeks after an infected animal has aborted all teem with virulent *Brucella*. Cows may lick those materials or the genital area of infected cows, or ingest the disease-causing organisms with contaminated food or water. Despite occasional exceptions, the general rule is that brucellosis is carried from one herd to another by an infected or exposed animal. This occurs when a herd owner buys replacement cattle which are infected or have been exposed to infection prior to purchase. In other words, brucellosis is usually bought and paid for!

Do ponds or streams contribute to the spread of brucellosis?

Ponds and streams are of minor importance in the spread of brucellosis except when they are sites for congregation. Animals in close proximity always increase the chances of exposure.

Do other ruminants figure in the spread of brucellosis?

Bison, moose, and elk are usually affected by *Brucella abortus* and caribou are affected by *Brucella suis*, Type 4. Infection has been found in many bison herds and in a few elk herds closely associated with affected bison or cattle populations. Elk apparently do not sustain a herd infection unless their natural behavior patterns have been altered. Affected bison herds can be freed of *Brucella* infection by applying the same program methods used for cattle. There is very little danger of the disease being transmitted to cattle from these animals unless there is an unusually close association between them.

What about dogs or predatory animals?

A dog, fox, or other animal can drag an aborted fetus from one farm to another and thereby spread brucellosis. Even people with contaminated shoes, clothing, or equipment can serve as mechanical vectors of the disease-causing organisms. But these are not common methods of spread.

The Eradication Program—How It Works

What is being done to fight brucellosis?

There is a cooperative State-Federal brucellosis eradication program aimed at eliminating the disease from the livestock population in this country. Like other animal disease eradication efforts, success of the program depends upon the willingness of livestock producers to participate. Before 1934, control of bovine brucellosis was limited mainly to individual herds. In 1934, a nationwide voluntary program to reduce brucellosis in cattle was begun under the direction of USDA in cooperation with the States. To make it a workable program, it was necessary to develop acceptable methods and rules. Today's "Uniform Methods and Rules" published by USDA set forth minimum standards for States to

conduct a brucellosis program. The greatest progress dates from 1954 when Congress made additional funds available for an accelerated program to eradicate the disease. Currently, all States participate in the brucellosis eradication effort.

What is the basic approach to eradication?

From the outset, the approach has involved testing cattle to find infection and sending infected animals to slaughter. Identification of market animals, surveillance testing to find infected animals, investigation of infected herds, and vaccination of replacement calves in high-risk areas are important features of the current program.

Have any other countries successfully eradicated brucellosis?

Yes. At least seven of the world's livestock-producing countries have managed to eradicate brucellosis, using primarily the test and slaughter approach. Most of the successful countries have been dairy and meat exporters. Virtually all developed countries have programs to control and eliminate brucellosis or to prevent its reintroduction.

What is area testing?

This is the testing of all herds in a given area such as a county. In the 1950's and 1960's, this approach was used to find and reduce infection sufficiently so counties and States could initially qualify as Modified-Certified Brucellosis Areas. Today, area testing is a key part of intensified eradication campaigns underway in several States.

How do we keep on the lookout for infection in cattle?

Two screening procedures are used to locate infection without having to test each animal of every herd. Dairy herds selling milk are checked at least three to four times a year by testing a small sample of milk obtained from the creamery or farm milk tank for evidence of brucellosis. Cattle herds which do not sell milk are checked for evidence of infection by testing blood samples obtained from identified cattle at livestock markets or at slaughter. In many areas, adult cattle are also subjected to blood tests for brucellosis upon change of ownership even if sold directly from one farm to another. Cattle remaining in the herds are not tested unless evidence of brucellosis is disclosed among the market animals.

What happens when evidence of disease is found?

Once located, infection is contained by quarantining all infected and exposed cattle and limiting their movement to slaughter only. Blood-testing procedures are used to find all infected cattle and free the herd of brucellosis. Also, Federal and State animal health officials check neighboring herds and others that may have received cattle from the infected herd. All possible leads to additional infection are traced.

Why do we have quarantine and limitation of movement?

Quarantining affected herds and limiting the movement of infected and exposed animals are fundamental in preventing the spread of disease to other herds in any geographic area. These measures are not enough by themselves to prevent the spread of brucellosis, but they are important tools.

How does the brucellosis ring test (BRT) work?

This procedure makes it possible to screen whole dairy herds quickly and economically. Milk or cream from each cow in the herd is pooled, and a sample is taken for testing. A suspension of stained, killed *Brucella* organisms is added to the sample. If a bluish ring forms at the cream line as the cream rises, it means there are one or more infected animals in the herd.

How does market cattle identification (MCI) work?

Numbered tags, called backtags, are placed on the shoulder of cattle that are marketed from beef as well as dairy herds. Blood samples are collected from the test-eligible animals at livestock markets or slaughtering plants and tested for brucellosis. If a sample reacts to the test, it is traced by means of the number on the backtag to determine the owner of the herd from which the animal originated. The owner is contacted by a State or Federal animal health official to arrange for testing of his herd. All of the eligible animals in the herd are tested at no cost to the owner.

More About Tests and the Disease

What is the blood agglutination test?

It is an effective, highly reliable method of diagnosing brucellosis. To pinpoint infection within a herd, a blood sample is taken from each animal and tested in the field or at a laboratory. The blood serum is mixed with a test fluid or antigen containing dead *Brucella* organisms. When the organisms in the test fluid clump together in a reaction known as agglutination, the test is positive and the animal is diseased.

What is the brucellosis card test?

It is a rapid, sensitive, and reliable procedure for diagnosing infection. It works much like the blood agglutination test but employs disposable materials contained in compact kits. *Brucella* antigen (containing stained, killed *Brucella* organisms) is added to the blood serum on a white card. Results of the test are read 4 minutes after the blood serum and antigen are mixed.

Are there any other tests for brucellosis?

Yes. A number of useful tests are based on various characteristics of antibodies found in the blood of infected animals. Some tests are especially useful in identifying infected animals in problem herds—herds which are difficult to free of brucellosis. With the rivanol and complement fixation tests, it is possible to tell actual infection from vaccination effects.

Also used in problem herds are the mercaptoethanol and Coombs antiglobulin tests. Fluorescent antibody tests as well as the agglutination test can be used on vaginal fluids. The serial ring test is available for milk of suspicious cattle, and the semen plasma test is useful in bulls with suspected genital infection.

Still another diagnostic test involves isolating *Brucella* organisms from the body of an animal or its discharges (milk, etc.) or from the aborted calf or fetal membranes or fluids.

How important is research to the eradication effort?

The eradication goal is based on sound technology. Thanks to years of research and experience, we have adequate tools and know-how to eradicate brucellosis. It already has been eliminated in wide

areas of the country. With substantial new funding, however, better tests and vaccine are being vigorously sought to speed up the eradication effort. APHIS-supported field trials and projects sponsored by USDA's Science and Education Administration are underway at several universities and the National Animal Disease Center, Ames, Iowa.

What are epidemiologists?

In the field of animal health, these are specially trained veterinarians who investigate disease sources and the means of stamping out infection in affected herds and areas. They are concerned with disease in a group or population of animals, and they evaluate circumstances connected with the occurrence of disease. Epidemiologists perform an important role in the campaign to eradicate brucellosis, by identifying factors essential to its control and prevention.

What is the incubation period of brucellosis?

The period of time between exposure of cattle to an infectious dose of organisms and the first appearance of disease signs is known as the incubation period. This period for brucellosis in cattle and other animals is quite variable—ranging from about 2 weeks to 8 months or longer. When abortion is the first sign observed, the minimum incubation period is about 30 days. Some cows abort before developing a positive reaction to the blood test. Other infected cows never abort. Usually, cattle develop a positive reaction to the test within 3 to 12 weeks after infection enters the body, although some may not develop a positive reaction for several months.

What are negative, exposed cattle?

These are animals found negative when tested for brucellosis but are known to have had direct exposure to the disease. They may have been in the incubation stage of the disease when tested. If allowed to be sold for breeding or dairying without further tests, they could spread infection to other herds.

Good Herd Management— Key To Prevention

Can brucellosis in animals be cured?

No. Many antibiotic, sulfonamide, mineral, and other treatments have been investigated and, so far, all

have been found to be ineffective. Occasionally, individual animals recover spontaneously after a long period of time. More commonly, however, only the symptoms disappear and the animals remain diseased. Such animals are dangerous sources of infection for other animals.

How is brucellosis eliminated from a herd?

Elimination of brucellosis from an affected herd depends upon testing at regular intervals (usually 30-day) and sending reactors to slaughter so that the exposure cycle is interrupted. Cleaning and disinfecting of the premises is an important part of the program when cattle are housed.

Are calves from infected dams a hazard to other cattle?

Calves are relatively resistant to infection and usually do not harbor *Brucella* after the source of their exposure is removed. There is some evidence, however, that introducing or retaining these calves as replacement animals may pose a risk, because of retention of undetectable infection resulting from exposure before birth. This problem is being investigated to determine how often such conditions may occur.

How well do disease-causing organisms survive outside the cow?

Generally, not very well although they have survived for several months under favorable conditions. The number of viable organisms will decline steadily unless the temperature is below freezing. Heat and direct sunlight destroy the brucellae. Good sanitation such as prompt disposal of a fetus will help reduce the presence of infective materials.

Can brucellosis be prevented?

The disease may be avoided by employing sound herd management. Replacement animals should be tested when purchased and retested not sooner than 60 nor later than 120 days afterward. They should be kept isolated from the established herd during this period. This will allow detection of animals that were in the incubation state of the disease when acquired. Also remember that *Brucella* are mostly shed at calving. All cattle about to calve should be isolated. Provide separate calving pens if possible. Return them to the herd after secretions from pregnancy have ceased.

Importance of Vaccination

What about calfhood vaccination?

USDA officials recommend vaccination of heifer calves. This is especially important in herds located within heavily infected areas or in herds that regularly sell replacement heifers to such areas. Dairy herds are a high-risk group because many herd owners purchase most of their replacement cattle. This increases the chance of buying infected animals for introduction into brucellosis-free herds. The purchase of vaccinated animals minimizes the problem of adding highly susceptible cattle to already infected herds. Some States do not allow cattle to be imported for breeding if they are not official vaccines and if they are beyond the age at which they should have been vaccinated.

How are vaccinated animals identified?

A tattoo is applied in the right ear at time of vaccination identifying the animal as an "official vaccinee." The tattoo gives the year and the quarter of the year vaccine was administered. Also at time of vaccination, a metal identification tag is put in the right ear. The tag number is recorded on a vaccination record or certificate.

Is there anything special about brucellosis vaccine?

The vaccine, known as Strain 19, is a live product and should be administered by an accredited veterinarian or regulatory official. For best results and to minimize interference with diagnostic tests, animals should be vaccinated when 2 to 6 months of age.

How effective is Strain 19?

This vaccine has been quite effective in reducing economic losses from cattle brucellosis. About 70 out of 100 cattle vaccinated as calves will have complete protection against most levels of natural exposure to brucellosis. The remaining 30 also will have protection to varying degrees. For best results, at least 80 percent of the cattle in a herd should be vaccinated. Up to 95 percent of the cattle in an all-vaccinated herd may be protected. In any case, it's easier and less costly to eliminate infection from a vaccinated herd.

Is Strain 19 vaccine safe?

Yes when used properly. Strain 19 is the only officially recognized brucellosis vaccine in this country.

It has never been shown to change to a virulent form. Calves, when vaccinated at the proper age, usually recover rapidly from the low-grade infection produced. And during the period of low-grade infection, Strain 19 organisms are not transmitted from vaccinated to nonvaccinated animals by contact.

What are the problems with vaccine use?

First, Strain 19 is a live product and must be properly handled to assure potency. Most problems stem from vaccinating calves that are over the recommended age—a practice that can seriously complicate diagnosis. This is because diagnosis is based on an agglutination test that measures the level of antibodies in the blood. These antibodies are the same—whether produced in response to vaccine or actual invasion of disease—and cannot be distinguished in a single test. The vaccination titer—concentration of antibodies that causes agglutination—appears in about 2 weeks and usually subsides in 3 to 8 months. This titer may occasionally persist especially in cattle vaccinated after 6 months of age. It is important to vaccinate calves as soon as possible after they reach 2 months of age and before they reach the upper age limits set by regulations for dairy and beef cattle.

How does adult vaccination fit in?

An adult vaccination plan is available for use in badly infected herds where cleanup has been a problem. It involves vaccinating nonreactor adult dairy or breeding cows with Strain 19 using a reduced dosage. Special movement restrictions apply to adult vaccinated cattle. The plan requires specific approval of State and Federal animal health officials. Successfully used in several higher-incidence States, adult vaccination is a way of giving quick protection to most animals in a herd.

The Economics of Brucellosis

Is brucellosis still costly for the cattle and dairy industry?

Cooperative State-Federal eradication efforts have reduced the percentage of infected cattle from over 11 percent to about one-half of 1 percent today. In the past 20 years, the number of infected dairy herds has been reduced from 247,000 to less than 600.

While most of the Nation is classified as brucellosis free or as low prevalence, 10 Southeastern and South-Central States still have a relatively high incidence. Economic losses to the beef cattle and dairy industry were calculated at \$30 million during 1976. With no program in effect, it was calculated that losses could exceed \$850 million annually in just 10 years.

How are owners of infected cattle compensated?

Owners of cattle found infected and sent to slaughter can receive Federal indemnity payments in addition to the salvage or slaughter value of such animals. The current Federal rates are: \$250 for all registered cattle; \$150 for certain nonregistered dairy cows; \$50 for nonregistered beef cows and bulls and nonregistered dairy bulls; and \$25 for heifer calves under 6 months of age nursing reactor dams. Some States provide indemnity in addition to the Federal payments.

The Swine Program

What are the plans to eradicate swine brucellosis?

Programs to eliminate swine brucellosis were initiated by several States during the 1960's. Most of the major hog-producing States are now participating. Several plans are followed. One plan calls for "validation" of individual herds using the testing and slaughter approach to eliminate infection. Another plan qualifies a county or State as "validated" when all herds in the area have been tested and infection eliminated. Most States follow a third plan which calls for (1) testing all herds selling breeding stock, (2) testing blood samples from 90 percent of all sows, boars, and stags going to slaughter, and (3) tracing reactors back to herds of origin. The herd is then tested and validated, or the entire herd is sent to slaughter. The key to this plan is the mandatory identification of sows and boars going to slaughter.

Are the owners of infected swine eligible for indemnity?

Yes. If infected animals are found in the herd, the owners can be paid indemnity on those animals in addition to their market value. The rate is \$25 per head for registered animals and \$10 per head for grade breeding animals.

Brucellosis in Humans

Generally, how does brucellosis affect its human victims?

Called undulant fever, brucellosis in humans is insidious at the onset and difficult to diagnose. It can be a serious public health problem for packing plant workers, veterinarians, and livestock handlers who come in contact with infected animals or the carcasses of such animals. With its recurring bouts of fever and malaise, undulant fever has ruined the productive lives of many persons. It is one of the most miserable diseases of man.

What are some of the symptoms of undulant fever?

The disease usually develops like the "flu" in its human victims but persists for several weeks or more. The initial symptoms are tiring easily and headaches, followed by high fever, chills, drenching sweats, joint pains, backache, and loss of weight and appetite. While the disease does not frequently cause human death, it is too serious to be dealt with lightly.

What are the main sources of human infection?

Years ago raw milk was considered the prime source of human brucellosis. Today, persons in this country are most likely to contract the disease by coming in direct contact with diseased animals or infected carcasses at slaughter. Rarely, if ever, does a human contract the disease from another human.

How common is human brucellosis in this country?

Fortunately, pasteurization and progress in eradicating brucellosis in livestock have resulted in substantially fewer human cases. The 232 cases reported in 1977 is a mere fraction of the 6,300 cases reported in 1947. Only about 9 percent of the recent cases were related to consumption of unpasteurized dairy products. Contact with infected swine continues to be a common source of infection, especially for packing plant workers. Recently, however, the greatest increase in human cases has occurred among livestock producers having contact with infected cattle.

Can people get brucellosis by eating meat?

There are no cases on record of people getting brucellosis by eating meat. This is because the disease-causing organisms tend to localize in the reproductive tract and udder, parts that are removed at slaughter. Also, the bacteria are readily killed by normal cooking temperatures.

How can people avoid becoming infected?

On the farm or ranch, the greatest danger to people comes from contact with placental tissues or other discharges from infected animals.

The following precautions are recommended:

- Clean contaminated areas such as calving pens or animal isolation areas.
- Wear protective gloves when helping animals give birth or abort, and scrub well afterward.
- Burn or bury aborted fetuses and contaminated placental tissues.
- Clean and disinfect areas where abortions have occurred.
- Avoid touching your eyes, nose, or mouth until you have washed your hands after handling animals—especially newborn—or raw milk or milking equipment.

Personal and area cleanliness habits are important, even when no known diseased animals are involved. Also important is the precaution to avoid drinking raw milk or eating any of its by-products. Pasteurization is simple and quick. It can save much suffering.

Human brucellosis is treatable. If you suspect you have it, see a physician promptly.

Ultimately, the best protection will be the eradication of brucellosis in livestock.

Cooperative State-Federal Brucellosis
Eradication Program
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